

## DETAILED ACTION

*This Office Action is in response to applicant's amendment filed 08/12/2011.*

*Claims 1-3, 5-6, 8-9, 11-14, 16, 19-21, 23, and 25-28 are currently pending in this application.*

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1-3, 8-9, 11, 13-14, 19, 21, 25, and 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Severson et al. (U.S. 6,560,551) in view of Fleming (U.S. 6,809,648).

Claim 1, Severson teaches:

**A system for detecting icing conditions external to a vehicle**

(Severson, Col. 3, Lines 22-36), **comprising:**

**a housing having a flow channel positioned along a flow axis, the flow channel having an entrance and an exit positioned to receive an airstream** (Severson, Col. 4, Lines 13-16, The flow axis is indicated by arrows 18, which is the flow of air. The apparatus 10 is the housing which includes a

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pitot tube that establishes a flow channel. Thus, the side of the pitot tube facing the air flow is an entrance position and the opposite side of the pitot tube is an exit position. It is noted that a similar structure is used for the vibrating probe 12.);

**a probe having a first surface positioned to face toward the airstream as the airstream travels along the flow axis, the probe further having a second surface facing opposite from the first surface** (Severson, Fig. 1, Col. 3, Lines 30-34, The left side of the vibrating probe is the first surface, and the right side of the probe is the second surface.);

**a temperature sensor carried by the probe** (Severson, Fig. 1, The term “carried by” is interpreted as “attached to”. As can be seen from the figure, the temperature sensor 30 and the probe 12 communicate with the computer 22. Thus, both devices are indirectly connected to each other.) **and being configured to direct a first signal corresponding to a temperature of the airstream** (Severson, Fig. 1: 30, Col. 4, Lines 16-20);

**a water content sensor carried by the probe** (Severson, Fig. 1, The term “carried by” is interpreted as “attached to”. As can be seen from the figure, the liquid water content sensor 32 and the probe 12 communicate with the computer 22. Thus, both devices are indirectly connected to each other.) **and being configured to direct a second signal corresponding to a water content of the airstream** (Severson, Fig. 1: 32, Col. 4, Lines 27-32); **and**

**a processing unit coupled to the temperature sensor and the water content sensor to receive the first and second signals** (Severson, Fig. 1: 22,

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Col. 3, Lines 59-67 through Col. 4, Lines 1-7) **and, based on at least the first and second signals, provide an indication when at least the first and second signals taken together correspond to an at least incipient icing condition** (Severson, Fig. 1: 34, Col. 3, Lines 42-47).

Severson does not specifically teach:

**The temperature sensor positioned in the flow channel along the flow axis between the entrance and the exit, the temperature sensor being positioned to face downstream at least proximate to the second surface of the probe; and**

**the water content sensor positioned in the flow channel along the flow axis between the entrance and the exit.**

Fleming teaches:

**The temperature sensor positioned in the flow channel along the flow axis between the entrance and the exit** (Fleming, Fig. 8: 820, Col. 5, Lines 50-55);

**the water content sensor positioned in the flow channel along the flow axis between the entrance and the exit** (Fleming, Fig. 8: 810, 840, Col. 2, Lines 41-43).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the liquid water content measurement apparatus in Severson by integrating the teaching of placing a temperature sensor and water content sensor in a flow channel as taught by Fleming.

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The motivation would be to provide an inexpensive and accurate device for measuring temperature and water content in an air flow (see Fleming, Col. 4, Lines 15-19).

Severson in view of Fleming does not specifically teach:

**The temperature sensor being positioned to face downstream at least proximate to the second surface of the probe.**

However, it would have been obvious to one of ordinary skill in the art at the time of the invention to shift the location of the temperature sensor to be downstream of the probe. Such a modification would not render the device incapable of performing its intended function, as the temperature sensor would still be able to measure the temperature of air in the airflow. See *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950) and MPEP § 2144.04.

Claim 2, Severson in view of Fleming further teaches:

**The water content sensor includes at least one of a liquid water content sensor, a total water content sensor and an ice crystal sensor** (Severson, Fig. 1: 32, Col. 4, Lines 27-32).

Claim 3, Severson in view of Fleming further teaches:

**The temperature sensor, the water content sensor and the processing unit are configured to mount to an aircraft** (Severson, Fig. 1, Col. 2, Lines 5-7).

Claim 8, Severson in view of Fleming further teaches:

**The temperature sensor is configured to detect a total temperature of the airstream** (Fleming, Col. 1, Lines 24-30).

Claim 9, Severson in view of Fleming further teaches:

**The temperature sensor is configured to detect a total temperature of the airstream, and wherein the processing unit is configured to determine a static temperature of the airstream based at least in part on the first signal** (Fleming, Col. 1, Lines 24-38).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to integrate the teaching of measuring total temperatures and calculating static temperatures, as taught by Fleming. The term total temperature is interpreted as a function of the aircraft speed and static temperature. The motivation would be to use known methods of measuring total temperatures and calculating static temperatures for an aircraft in flight for determining ice conditions (see Fleming, Col. 1, Lines 39-40).

Claim 11, Severson in view of Fleming further teaches:

**The processing unit is operatively couplable to a pressure sensor to receive a third signal corresponding to a pressure of the airstream** (Fleming, Fig. 8: 830, Col. 5, Lines 62-65), **and wherein the processing unit is configured to provide the indication based on the first, second and third**

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**signals** (Fleming, Col. 6, Lines 10-24, The electronic circuitry, computers, or other processing systems in Fleming is a processing unit.).

Claim 13, Severson teaches:

**A system for detecting icing conditions external to a vehicle**

(Severson, Col. 3, Lines 22-36), **comprising:**

**a housing having a flow channel positioned along a flow axis, the flow channel having an entrance and an exit positioned to receive an airstream** (Severson, Col. 4, Lines 13-16, The flow axis is indicated by arrows 18, which is the flow of air. The apparatus 10 is the housing which includes a pitot tube that establishes a flow channel. Thus, the side of the pitot tube facing the air flow is an entrance position and the opposite side of the pitot tube is an exit position. It is noted that a similar structure is used for the vibrating probe 12.);

**a probe having a first surface positioned to face toward the airstream as the airstream travels along the flow axis, the probe further having a second surface facing opposite from the first surface** (Severson, Fig. 1, Col. 3, Lines 30-34, The left side of the vibrating probe is the first surface, and the right side of the probe is the second surface.);

**temperature sensing means configured to sense a temperature of an airstream and direct a first signal corresponding to the temperature** (Severson, Fig. 1: 30, Col. 4, Lines 16-20), **the temperature sensing means being carried by the probe** (Severson, Fig. 1, The term “carried by” is

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interpreted as “attached to”. As can be seen from the figure, the temperature sensor 30 and the probe 12 communicate with the computer 22. Thus, both devices are indirectly connected to each other.);

**water content sensing means carried by the probe** (Severson, Fig. 1, The term “carried by” is interpreted as “attached to”. As can be seen from the figure, the liquid water content sensor 32 and the probe 12 communicate with the computer 22. Thus, both devices are indirectly connected to each other.) **and configured to sense a water content of the airstream and direct a second signal corresponding to the water content** (Severson, Fig. 1: 32, Col. 4, Lines 27-32); **and**

**processing means coupled to the temperature sensing means and the water content sensing means and configured to receive the first and second signals** (Severson, Fig. 1: 22, Col. 3, Lines 59-67 through Col. 4, Lines 1-7) **and, based at least on the first and second signals, provide an indication when at least the first and second signals taken together correspond to an at least incipient icing condition** (Severson, Fig. 1: 34, Col. 3, Lines 42-47).

Severson does not specifically teach:

**The temperature sensor positioned in the flow channel along the flow axis between the entrance and the exit, the temperature sensor being positioned to face downstream at least proximate to the second surface of the probe; and**

**the water content sensor positioned in the flow channel along the flow axis between the entrance and the exit.**

Fleming teaches:

**The temperature sensor positioned in the flow channel along the flow axis between the entrance and the exit** (Fleming, Fig. 8: 820, Col. 5, Lines 50-55);

**the water content sensor positioned in the flow channel along the flow axis between the entrance and the exit** (Fleming, Fig. 8: 810, 840, Col. 2, Lines 41-43).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the liquid water content measurement apparatus in Severson by integrating the teaching of placing a temperature sensor and water content sensor in a flow channel as taught by Fleming.

The motivation would be to provide an inexpensive and accurate device for measuring temperature and water content in an air flow (see Fleming, Col. 4, Lines 15-19).

Severson in view of Fleming does not specifically teach:

**The temperature sensor being positioned to face downstream at least proximate to the second surface of the probe.**

However, it would have been obvious to one of ordinary skill in the art at the time of the invention to shift the location of the temperature sensor to be downstream of the probe. Such a modification would not render the device incapable of performing its intended function, as the temperature sensor would

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still be able to measure the temperature of air in the airflow. See *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950) and MPEP § 2144.04.

Claim 14, Severson in view of Fleming further teaches:

**The temperature sensing means, the water content sensing means and the processing means are configured to mount to an aircraft** (Severson, Fig. 1, Col. 2, Lines 5-7).

Claim 19, Severson teaches:

**A method for detecting icing conditions external to a vehicle** (Severson, Col. 3, Lines 22-36), **comprising:**  
**receiving signals from a device carried external to the vehicle** (Severson, Col. 4, Lines 13-16, Col. 3, Lines 30-34, Col. 4, Lines 16-20, The pitot tube, the vibrating probe, the temperature sensor, and the liquid water content sensor are all exposed to the outside of the aircraft, and thus are external to the vehicle.), **the device including:**

**a housing having a flow channel positioned along a flow axis, the flow channel having an entrance and an exit positioned to receive an airstream** (Severson, Col. 4, Lines 13-16, The flow axis is indicated by arrows 18, which is the flow of air. The apparatus 10 is the housing which includes a pitot tube that establishes a flow channel. Thus, the side of the pitot tube facing the air flow is an entrance position and the opposite side of the pitot tube is an

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exit position. It is noted that a similar structure is used for the vibrating probe 12.);

**a probe having a first surface positioned to face toward the airstream as the airstream travels along the flow axis, the probe further having a second surface facing opposite from the first surface** (Severson, Fig. 1, Col. 3, Lines 30-34, The left side of the vibrating probe is the first surface, and the right side of the probe is the second surface.);

**a temperature sensor carried by the probe** (Severson, Fig. 1, The term “carried by” is interpreted as “attached to”. As can be seen from the figure, the temperature sensor 30 and the probe 12 communicate with the computer 22. Thus, both devices are indirectly connected to each other.), **and being configured to direct a first signal corresponding to a temperature of the airstream** (Severson, Fig. 1: 30, Col. 4, Lines 16-20);

**a water content sensor carried by the probe** (Severson, Fig. 1, The term “carried by” is interpreted as “attached to”. As can be seen from the figure, the liquid water content sensor 32 and the probe 12 communicate with the computer 22. Thus, both devices are indirectly connected to each other.) **configured to direct a second signal corresponding to a water content of the airstream** (Severson, Fig. 1: 32, Col. 4, Lines 27-32), **wherein receiving signals includes**

**receiving a first signal from the water temperature sensor corresponding to a temperature of an airstream external to a vehicle** (Severson, Fig. 1: 30, Col. 4, Lines 16-20);

**receiving a second signal from the water content sensor corresponding to a water content of the airstream (Severson, Fig. 1: 32, Col. 4, Lines 27-32); and**

**based on at least the first and second signals, automatically generating an indication when at least the first and second signals taken together correspond to an at least incipient icing condition (Severson, Fig. 1: 34, Col. 3, Lines 42-47).**

Severson does not specifically teach:

**The temperature sensor positioned in the flow channel along the flow axis between the entrance and the exit, the temperature sensor being positioned to face downstream at least proximate to the second surface of the probe; and**

**the water content sensor positioned in the flow channel along the flow axis between the entrance and the exit.**

Fleming teaches:

**The temperature sensor positioned in the flow channel along the flow axis between the entrance and the exit (Fleming, Fig. 8: 820, Col. 5, Lines 50-55);**

**the water content sensor positioned in the flow channel along the flow axis between the entrance and the exit (Fleming, Fig. 8: 810, 840, Col. 2, Lines 41-43).**

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the liquid water content measurement

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apparatus in Severson by integrating the teaching of placing a temperature sensor and water content sensor in a flow channel as taught by Fleming.

The motivation would be to provide an inexpensive and accurate device for measuring temperature and water content in an air flow (see Fleming, Col. 4, Lines 15-19).

Severson in view of Fleming does not specifically teach:

**The temperature sensor being positioned to face downstream at least proximate to the second surface of the probe.**

However, it would have been obvious to one of ordinary skill in the art at the time of the invention to shift the location of the temperature sensor to be downstream of the probe. Such a modification would not render the device incapable of performing its intended function, as the temperature sensor would still be able to measure the temperature of air in the airflow. See *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950) and MPEP § 2144.04.

Claim 20, Severson in view of Fleming further teaches:

**Receiving the second signal includes receiving the second signal from at least one of a liquid water content sensor, a total water content sensor and an ice crystal sensor** (Severson, Fig. 1: 32, Col. 4, Lines 27-32).

Claim 21, Severson in view of Fleming further teaches:

**The processes of receiving the first signal, receiving the second signal and automatically generating an indication of claim are performed**

**on board an aircraft** (Severson, Fig. 1: 22, Col. 3, Lines 59-67 through Col. 4, Lines 1-7, The processes of receiving the signals and generating an indication are performed by a processor or computer of the system which is installed in an aircraft (see also Severson, Col. 2, Lines 5-7).).

Claim 25, Severson in view of Fleming further teaches:

**Receiving a first signal includes receiving a first signal corresponding to a total temperature of the airstream, and wherein the method further comprises determining a static temperature of the airstream based at least in part on the first signal** (Fleming, Col. 1, Lines 24-38).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to integrate the teaching of measuring total temperatures and calculating static temperatures, as taught by Fleming. The term total temperature is interpreted as a function of the aircraft speed and static temperature. The motivation would be to use known methods of measuring total temperatures and calculating static temperatures for an aircraft in flight for determining ice conditions (see Fleming, Col. 1, Lines 39-40).

Claim 27, Severson in view of Fleming further teaches:

**The temperature sensor includes a static temperature sensor** (Fleming, Col. 1, Lines 24-31, It would have been obvious to one of ordinary skill in the art to use the TAT probe for measuring static temperatures. The

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motivation would be to determine icing conditions with the TAT probe, which is well-known in the art and required by the FAA.).

Claim 28, Severson in view of Fleming further teaches:

**The flow axis is a generally straight flow axis between the entrance and the exit** (Fleming, Fig. 8: 610, 640, Col. 5, Lines 50-55, The incoming pipe and the outgoing pipe are generally in a straight line from each other, thus the flow of air is generally a straight flow axis.).

2. Claims 5-6, 16, 23, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Severson et al. (U.S. 6,560,551) in view of Fleming (U.S. 6,809,648), and further in view of Forgue et al. (U.S. 4,333,004).

Claim 5, Severson in view of Fleming does not teach:

**The water content sensor includes a heated wire positioned to be impinged by water contained in the airstream.**

Forgue teaches:

**The water content sensor includes a heated wire positioned to be impinged by water contained in the airstream** (Forgue, Col. 3, Lines 21-30).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the liquid water content measurement apparatus in Severson in view of Fleming by integrating the teaching of a reference and sensor wire as taught by Forgue.

The motivation would be to accurately detect the presence of ice and avoiding false indications when water is present (see Forgue, Col. 3, Lines 35-39).

Claim 6, Severson in view of Fleming teaches:

**The processing unit is configured to provide a positive indication of an at least incipient icing condition when the temperature sensor detects a temperature corresponding to a static temperature, and the water content sensor detects liquid water** (Severson, Col. 3, Lines 59-67 through Col. 3, Lines 1-7).

Severson in view of Fleming does not specifically teach:

**The temperature sensor detects a temperature corresponding to a static temperature at or below a local freezing point for water.**

Forgue teaches:

**The local freezing point of water changes with vehicle velocity and changes in air pressure** (Forgue, Col. 1, Lines 44-58).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the temperature measured in Severson in view of Fleming to measure a static temperature at or below a local freezing point for water when the aircraft is in motion, as taught by Forgue. It is further noted that the term static temperature is interpreted as being the temperature measured by a temperature sensor at a specific location, i.e. ambient temperature.

The motivation would be to accurately detect the presence of ice and avoiding false indications when water is present (see Forgue, Col. 3, Lines 35-39).

Claim 16, Severson in view of Fleming teaches:

**The processing means is configured to provide a positive indication of an at least incipient icing condition when the temperature sensing means detects a temperature corresponding to a static temperature, and the water content sensor detects liquid water** (Severson, Col. 3, Lines 59-67 through Col. 3, Lines 1-7).

Severson in view of Fleming does not specifically teach:

**The temperature sensor detects a temperature corresponding to a static temperature at or below a local freezing point for water.**

Forgue teaches:

**The local freezing point of water changes with vehicle velocity and changes in air pressure** (Forgue, Col. 1, Lines 44-58).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the temperature measured in Severson in view of Fleming to measure a static temperature at or below a local freezing point for water when the aircraft is in motion, as taught by Forgue. It is further noted that the term static temperature is interpreted as being the temperature measured by a temperature sensor at a specific location, i.e. ambient temperature.

The motivation would be to accurately detect the presence of ice and avoiding false indications when water is present (see Forgue, Col. 3, Lines 35-39).

Claim 23, Severson in view of Fleming teaches:

**Determining when the temperature sensor detects a temperature corresponding to a static temperature** (Severson, Col. 3, Lines 59-67 through Col. 3, Lines 1-7);

**determining when the water content sensor detects liquid water** (Severson, Col. 4, Lines 27-32); **and**

Breda does not teach:

**Detecting a temperature corresponding to a static temperature at or below a local freezing point for water; and**

**generating the indication only when both the temperature sensor detects a temperature corresponding to a static temperature at or below a local freezing point for water and the water content sensor detects liquid water.**

Forgue teaches:

**The local freezing point of water changes with vehicle velocity and changes in air pressure** (Forgue, Col. 1, Lines 44-58).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the temperature measured in Severson in view of Fleming to measure a static temperature at or below a local freezing point for

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water when the aircraft is in motion, as taught by Forgue. It is further noted that the term static temperature is interpreted as being the temperature measured by a temperature sensor at a specific location, i.e. ambient temperature.

The motivation would be to accurately detect the presence of ice and avoiding false indications when water is present (see Forgue, Col. 3, Lines 35-39).

Furthermore, as per the limitation of **generating the indication only when both the temperature sensor detects a temperature corresponding to a static temperature at or below a local freezing point for water and the water content sensor detects liquid water**, it would have been obvious to one of ordinary skill in the art to modify the indication in Severson in view of Fleming with the ability to measure temperatures at or below freezing in Forgue. The motivation would be to prevent liquid water particles from instantaneously freezing on an aircraft by activating the deicing system, as is known in the art (see Severson, Col. 4, Lines 41-62).

Claim 26, Severson in view of Fleming teaches:

**Receiving a third signal corresponding to a pressure of the airstream**  
(Fleming, Fig. 8: 830, Col. 5, Lines 62-65).

Severson in view of Fleming does not teach:

**Determining whether the first signal corresponds to a temperature at or below which water freezes, based on the first signal and the third signal.**

Forgue teaches:

**The local freezing point of water changes with vehicle velocity and changes in air pressure** (Forgue, Col. 1, Lines 44-58).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the temperature measured by the temperature probe in Severson in view of Fleming would measure a static temperature at or below a local freezing point for water when the aircraft is in motion, as taught by Forgue. It is further noted that the term static temperature is interpreted as being the temperature measured by a temperature sensor at a specific location, i.e. ambient temperature. Therefore, the combination of Severson in view of Fleming, and further in view of Forgue would be able to determine the freezing point temperature of the aircraft at a measured pressure.

The motivation would be to accurately detect the presence of ice and avoiding false indications when water is present (see Forgue, Col. 3, Lines 35-39).

3. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Severson et al. (U.S. 6,560,551) in view of Fleming (U.S. 6,809,648), and further in view of Palmer (U.S. 5,796,612).

Claim 12, Severson in view of Fleming teaches:

**Each of the temperature sensor, the water content sensor and the processing unit is carried by at least one of the fuselage portion, the wing portion, the empennage portion and the propulsion system** (Fleming, Col. 3,

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Lines 24-33, The sampler system is attached to the external surface of the aircraft. Therefore, it would be obvious to one of ordinary skill in the art to attach the sampler system to the fuselage, wing, empennage, or propulsion system of a plane such that airflow may be measured.).

Severson in view of Fleming does not explicitly teach:

**An aircraft having a fuselage portion, a wing portion, an empennage portion and a propulsion system.**

Palmer teaches:

**An aircraft having a fuselage portion** (Palmer, Fig. 17: 440, Reference port is installed within the fuselage portion of the aircraft.), **a wing portion** (Palmer, Fig. 17: 580 (on the wing)), **an empennage portion** (Palmer, Fig. 17: 580 (on the tail)) **and a propulsion system** (Palmer, Fig. 17).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to integrate the liquid water content measurement apparatus in Severson in view of Fleming into an aircraft as taught by Palmer.

The motivation would be to maximize performance of the aircraft, such as detecting when icing occurs on the tail when the aircraft requires lift so that adjustments may be made (see Palmer, Col. 8, Lines 32-39).

### ***Response to Arguments***

Applicant's arguments with respect to claims 1-3, 5-6, 8-9, 11-14, 16, 19-21, 23, and 25-28 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAMES YANG whose telephone number is (571)270-5170. The examiner can normally be reached on M-F 8:30-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Zimmerman can be reached on 571-272-3059. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/J. Y./

/Brian A Zimmerman/  
Supervisory Patent Examiner, Art Unit 2612